POR SF
11.3.60-3
08/31/2005

ST SERVICES/SHORE TERMINALS
CSM Site Summary

ST SERVICES/SHORE TERMINALS

Oregon DEQ ECSI #: 1989

9400 NW St. Helens Road
DEQ Site Mgr: Tom Gainer
Latitude: 45.5888°
Longitude: -122.7731°
Township/Range/Section: 1N/1W/11

River Mile: 5.4 West bank

LWG Member ☐ Yes ☒ No

Upland Analytical Data Status: ☐ Electronic Data Available ☒ Hardcopies only

1. SUMMARY OF POTENTIAL CONTAMINANT TRANSPORT PATHWAYS TO THE RIVER

The current understanding of the transport mechanism of contaminants from the uplands portions of the ST Services/Shore Terminals site to the river is summarized in this section and Table 1, and supported in following sections. No data are available on operations at this facility since Time Oil's sale of the facility in 1999.

1.1. Overland Transport

The area in the vicinity of the office and truck loading rack is paved. Based on an aerial photograph (undated), the remainder of the site is covered in gravel and/or soil. The tank farm is surrounded by containment berms and stormwater is routed to a wastewater treatment system (see Section 10.3). No information on drainage of the loading rack, or other site features is provided in the available files.

1.2. Riverbank Erosion

There is no discussion of the riverbank in the available files other than that the riverbank is outside the operational areas of ST Services.

1.3. Groundwater

Groundwater flow direction at ST Services is toward the Willamette River (Time Oil Co. 1999). As of 1999, there was not a complete groundwater transport pathway for dissolved chemicals to the river since the most recent groundwater monitoring results (1997) and results from four consecutive prior events (1995-97) indicate concentrations of petroleum-related constituents [COIs, including benzene, toluene, ethylbenzene, and xylenes (BTEX)] below detection limits in the groundwater monitoring wells closest to the river (Time Oil Co. 1999).

1.4. Direct Discharge (Overwater Activities and Stormwater/Wastewater Systems)

Prior to 1999 (when Time Oil owned the property), stormwater runoff from the tank farm area was collected in the storm drain catch basin, which was fitted with a multi-media insert designed to control sediment, petroleum hydrocarbons, and debris and to keep the material from entering the Willamette River, which was the ultimate discharge point of the catch basin. Stormwater was discharged under a National Pollutant Discharge Elimination System (NPDES) General Stormwater Discharge Permit No. 1200-Z, File No. 109938, ORR70-2234. The status of the

current stormwater system under ST/Shore Terminals is unknown.

There were historical overwater activities conducted on the marine dock, but no releases have been reported in the information available.

1.5. Relationship of Upland Sources to River Sediments

See Final CSM Update.

1.6. Sediment Transport

ST Services is located along the west bank of the river at approximately RM 5.4. This is within the relatively narrow river reach from RM 5 to 7 that is characterized as a transport/non-depositional zone based on the site physical information compiled in the Programmatic Work Plan (Integral et al. 2004). The Sediment Trend Analysis® results indicate that sediment movement along this side of the river alternates between net accretion and net deposition, transitioning to dynamic equilibrium in the center and east of the channel. The time-series bathymetric change data over the 25-month period from January 2002 through February 2004 show a contiguous nearshore area of sediment erosion (up to 2 ft) upstream of the ST Services dock out to about the –25 ft NAVD88 contour. The nearshore area adjacent to and downstream of the dock is a mixture of no change and sediment accretion and scour on the order of 1 ft (Integral and DEA 2004). In the center of main channel offshore of the site, a propagating sand wave field is evident from the bathymetric change data. Its well-defined, mid-channel position, suggests that these bed forms are the result of ship-induced bow waves impinging on the bottom in this portion of the navigation channel.

2. CSM SITE SUMMARY REVISIONS

Date of Last Revision: August 31, 2005

3. PROJECT STATUS

[Primary Source: DEQ 2004; Time Oil Co. 1999]

Activity		Date(s)/Comments
PA/XPA	☒	PA equivalent (Site Assessment – soil investigation and groundwater and vapor monitoring wells installed): 1989 and 1993; Groundwater Monitoring: 1994 – 1997; Corrective Action Plan – 1997; Vapor Extraction – 1997.
RI	☐	
FS	☐	
Interim Action/Source Control	☒	175 cubic yards of petroleum impacted soil was removed, treated onsite, and returned to the excavation – 1998; 125 cubic yards of petroleum impacted soil was removed, treated onsite, and returned to the excavation – 1992.
ROD	☐	
RD/RA	☐	
NFA	☒	DEQ notification – the site will not be listed in the Confirmed Release List – 1997.

DEQ Portland Harbor Site Ranking (Tier 1, 2, 3, or Not ranked): Tier 2

4. SITE OWNER HISTORY

[Primary Source: DEQ 1999; Time Oil Co. 1999]

Owner/Occupant	Type of Operation	Years
Shore Terminals, LLC (owner) ST Services (operator)	Bulk petroleum storage and marine terminal	1999-present
Portland Terminals Co. (owner) Time Oil Co. (operator)	Bulk petroleum storage and marine terminal	1979-1999

5. PROPERTY DESCRIPTION

[Primary Source: DEQ 1999; Time Oil Co. 1999]

ST Services is located at 9100 NW St. Helens Road in Portland, Oregon, and is currently owned by Shore Terminals, LLC. The site is currently a bulk petroleum storage and transfer facility and marine terminal. The site is approximately nine acres in size, and is zoned for heavy industrial use. The site includes two parcels; a rectangular-shaped property that includes the main site operational area, and a wooded, triangular-shaped parcel located between St. Helens Road and Front Avenue, to the southwest of the main operational area. The adjacent properties include the following: a bulk petroleum terminal to the northwest, a railroad right-of-way to the southwest, a tugboat marina to the southeast, and the Willamette River to the northeast.

The site is relatively flat, with an elevation of approximately 30 to 40 feet above mean sea level. The site is completely surrounded by a chain-link fence and the entry is gated. The main features of the property include 11 aboveground storage tanks (ASTs), located in a containment area, an underground storage tank (UST) used for wastewater treatment, an office, a truck loading rack, and an undeveloped area. The area in the vicinity of the office and truck loading rack is paved. Based on an aerial photograph (undated), the remainder of the site is covered in gravel and/or soil.

6. CURRENT SITE USE

[Primary Source: DEQ 1999; Time Oil Co. 1999]

ST Services is currently used as a bulk petroleum storage and transfer facility and marine terminal. There is no information available on current fuel storage and operations at the facility.

7. SITE USE HISTORY

[Primary Source: DEQ 1999; Time Oil Co. 1999]

The site was vacant prior to development by Time Oil Co. as a bulk petroleum terminal in 1979. Prior to 1999, fuel products stored in the bulk storage tanks included various grades of gasoline and diesel fuel, stove oil, reformate, ethanol, transmix, kerosene, JP-8, various proprietary fuel additives, and red fuel dye. Waste products generated and stored onsite included gasoline and diesel contaminated wastewater, absorbent materials and tank sludge, spent sandblasting sand, and ethyl/methyl alcohol contaminated wastewater.

Trenches and collection sumps collected wastewater at the site and discharged to an oil/water separator located below grade. The oil water separator discharged water to the City of Portland sanitary sewer system and product to an underground product recycle tank. No other information on the source of waste, the volumes generated, or details of the waste stream is provided in the available files.

Shore Terminals, LLC purchased the facility from Time Oil in October 1999. It is not known what specific fuel products are currently stored onsite or what waste products are currently generated or stored onsite.

8. CURRENT AND HISTORIC SOURCES AND COPCS

The understanding of historic and current potential upland and overwater sources at the site is summarized in Table 1. The following sections provide a brief overview of the potential sources and COPCs at the site requiring additional discussion.

8.1. Uplands

[Primary Source: DEQ 1999; Time Oil Co. 1999]

The bulk petroleum storage tank farm area, which includes 11 ASTs, one wastewater treatment UST, and associated petroleum transfer, receipt, and related facilities, is considered to be a current and historic source for contaminants of petroleum-related constituents in soil and groundwater. Two historic releases in the tank farm area in 1988 and 1992 resulted in impacts to soil and groundwater. Soil in this area was removed and treated following each release and a soil vapor extraction system was installed and operated to remove residual petroleum hydrocarbons in soil. The most recent groundwater monitoring results (1997) indicate concentrations of petroleum-related constituents below detection or below historical groundwater cleanup levels previously established by DEQ for petroleum UST contaminated sites (OAR 340-122-242) in all the groundwater monitoring wells and vapor extraction wells.

8.2. Overwater Activities

☒ Yes ☐ No

A dock extends approximately 90 ft into the Willamette River from the site. The dock is used for the mooring of tanker ships while transferring petroleum products to pipelines located on the dock. No overwater spills or releases have been documented or reported during overwater activities.

8.3. Spills

Known or documented spills at the ST Services/Shore Terminals site were obtained either from Time Oil or DEQ records. These spills are summarized below.

[Primary Source: DEQ 1999; Time Oil Co. 1999]

Date	Material(s) Released	Volume Spilled (gallons)	Spill Surface (gravel, asphalt, sewer)	Action Taken (yes/no)
1988	gasoline	1,000	Soil located in containment area. Small volume also spilled northeast and southeast of the containment area	Yes – 175 cubic yards of soil removed, treated, and returned to excavation
1992	gasoline	250	Soil located in containment area	Yes – 125 cubic yards of soil removed, treated, returned to excavation

9. PHYSICAL SITE SETTING

Numerous subsurface investigations and groundwater monitoring events have been conducted since the mid 1990s. As of 1999, there were four groundwater monitoring wells, two groundwater recovery/vapor extraction wells, and three vapor extraction/observation wells located at the site. Well locations are shown on Supplemental Figure 3 from Time Oil Co. (1999).

9.1. Geology

Based on data collected during the 1997 monitoring well and remediation system installation,

subsurface soil consists of sand to a depth of approximately 20 feet below ground surface (BGS) underlain by a clayey silt layer that extends to at least 30 ft bgs (Alisto 1997). Fill material, consisting of sand and silt, was historically placed in the site vicinity on alluvial floodplain materials. The depth to groundwater in the surficial unconfined aquifer ranges from approximately 15 to 23 ft bgs (DEQ 1999).

9.2. Hydrogeology

One water-bearing zone (the surficial aquifer) has been identified at the site and occurs in the fill material and alluvial floodplain materials. Groundwater level data collected from monitoring wells located in the surficial, unconfined aquifer indicate the depth to groundwater ranges from approximately 15 to 23 ft bgs (DEQ 1999). The water level data indicate that flow direction is to the northeast toward the Willamette River at gradients ranging from 0.018 to 0.026 (DEQ 1999).

10. NATURE AND EXTENT (*Current Understanding*)

The current understanding of the nature and extent of contamination for the uplands portions of the site is summarized in this section. When no data exist for a specific medium, a notation is made. The current understanding of the nature and extent of contamination is based on information from 1999 (Time Oil Co. 1999; DEQ 1999). No data are available from this site since Time Oil's sale of the facility in 1999.

10.1. Soil

10.1.1. Upland Soil Investigations

☒ Yes ☐ No

Two releases of petroleum to soil occurred in 1988 and 1992 (see Section 8.3). In both instances, soil was excavated from the impacted areas and aerated onsite. The release in 1988 resulted in the discharge of 1,000 gallons of gasoline to soil with the containment berm of the tank farm. Approximately 175 cubic yards of soil were excavated and aerated onsite. Soil samples collected from below the excavated areas ranged from less than 2 mg/kg to 7.3 mg/kg total petroleum hydrocarbons (Alisto 1997).

During the 1992 release, 250 gallons of gasoline were discharged to soil within the containment berm. Approximately 125 cubic yards of soil were excavated and aerated onsite. One soil sample collected from below the excavated area had a total petroleum hydrocarbon concentration of 9,000 mg/kg. Groundwater below the release area was found to contain petroleum constituents (see Section 10.2). In 1997, a vapor extraction system was installed to treat the impacted soil. The treatment system operated for two months, and was discontinued because petroleum-related constituents (BTEX) were not detected in the system discharge.

Soil data are limited, available data is summarized below.

Analyte	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)
Total Petroleum Hydrocarbons (TPH)		
Gasoline	< 2	9,000
Volatile Organic Compounds (VOCs)		
Benzene	ND	2.4

mg/kg = milligrams per kilogram (ppm)
ND = Not detected

10.1.2. River Bank Samples

☐ Yes ☒ No

No riverbank samples have been collected at the site. The riverbank is outside the operational areas of ST Services; therefore, no riverbank sediments have been exposed to materials formerly stored or handled at ST Services. No data are available on operations at this facility since Time Oil's sale of the facility in 1999.

10.1.3. Summary

Petroleum hydrocarbon impacted soils resulting from the release of gasoline in 1988 and 1992 were excavated, aerated onsite, and ultimately used as fill in the excavations. Petroleum hydrocarbons in soil, if remaining, are not significantly impacting groundwater concentrations (DEQ 1997), as discussed in Section 10.2.

10.2. Groundwater

10.2.1. Groundwater Investigations

☒ Yes ☐ No

Four groundwater monitoring wells (MW-1 through MW-4) were installed in 1989, following the 1988 release of gasoline to soil. Groundwater samples collected from these wells did not contain concentrations of petroleum-related constituents (BTEX) exceeding historical groundwater cleanup levels previously established by DEQ for petroleum UST contaminated sites (OAR 340-122-242). There were no groundwater cleanup levels established under these regulations for diesel-range or gasoline-range petroleum hydrocarbons.

An additional groundwater monitoring well (VRUMW-1) and three vapor monitoring wells (VO-1 through VO-3) were installed following the 1992 release. A groundwater sample collected from VRUMW-1 in 1993 contained BTEX concentrations exceeding DEQ's historical UST groundwater cleanup levels.

A total of eight groundwater monitoring events were conducted from 1993 through 1997. Groundwater samples were analyzed for petroleum constituents, including BTEX and diesel-range and gasoline-range hydrocarbons (prior to 1996). Petroleum constituents were not detected above laboratory detection limits in samples collected from MW-1 through MW-4 at any time during the monitoring program, with the exception of low concentrations of diesel-range hydrocarbons (ranging from 81 to 130 µg/L) in 1994. BTEX concentrations exceeded the historic DEQ UST groundwater cleanup levels in VRUMW-1 in 1993 with a maximum benzene concentration of 120 µg/L. BTEX concentrations were below these levels in 1995, and were below laboratory detection limits by 1997.

In April 1997, an additional well (VRUMW-2) was installed in the vicinity of the 1992 release area. At this time, all onsite wells were sampled (including the vapor extraction wells). Only one sample (collected from VO-1) contained detectable BTEX concentrations; however, the concentrations were below the historic DEQ UST cleanup levels. Groundwater samples collected from the monitoring wells located closest to river during five monitoring events between 1995 and 1997 (most recent) did not contain concentrations of COIs exceeding detection limits.

10.2.2. NAPL (Historic & Current)

☐ Yes ☒ No

No NAPL has been measured in the site monitoring wells.

10.2.3. Dissolved Contaminant Plumes

☐ Yes ☒ No

No gasoline constituents were measured in the most recent monitoring event (1997).

Plume characterization status ☒ Complete ☐ Incomplete

Plume Extent

Historically, a groundwater gasoline plume originating from the 1992 spill was present in the general area of the vapor extraction wells shown on Supplemental Figure 3. Site COIs were below laboratory detection limits by 1997 in all site wells. As such, no plume map is provided. No information beyond 1999 is available.

Min/Max Detections (Current situation)

Maximum historical concentrations included 120 µg/L benzene and 130 µg/L diesel-range petroleum hydrocarbons. There were no detections of site COIs in the most recent groundwater sampling event (1997).

Current Plume Data

Preferential Pathways

No information has been presented regarding the depths of the utilities at the facility relative to the shallow groundwater table or if the utility and associated backfill may be a preferential pathway at the site.

Downgradient Plume Monitoring Points (min/max detections)

Monitoring Wells MW-2, MW-3, and MW-4 are located downgradient of the 1989 release and the abovegrade storage tanks. No COIs have been detected in these wells. MW VRUMW-2 is located downgradient of the 1992 release and the truck loading rack. No COIs were detected in this well in the most recent monitoring event (1997).

Visual Seep Sample Data

☐ Yes ☒ No

No visual seeps have been identified in site documents.

Nearshore Porewater Data

No nearshore porewater data has been identified in site documents.

Groundwater Plume Temporal Trend

The maximum benzene concentration measured in site wells was 120 µg/L in VRUMW-1 in 1993. Detections in all wells decreased to below detection limits by 1997.

10.2.4. Summary

Based on data prior to and including 1999 when Time Oil owned the property, there was no complete exposure pathway of dissolved chemicals from groundwater to the river since the most recent groundwater monitoring results (1997) indicated concentrations of COIs below detection or below historical groundwater cleanup levels previously established by DEQ for petroleum UST contaminated sites (OAR 340-122-242). For the wells closest to the river, no COIs were detected during five consecutive events between 1995 and 1997 (Time Oil 1999). Current conditions are unknown.

10.3. Surface Water

10.3.1. Surface Water Investigation ☐ Yes ☒ No

Information is available for the stormwater system that was used by Time Oil prior to the property's sale to ST/Shore Terminals. Prior to 1999, stormwater runoff from the tank farm area was collected in the storm drain catch basin, which was fitted with a multi-media insert designed to control sediment, petroleum hydrocarbons, and debris and to keep the material from entering the Willamette River, which was the ultimate discharge point of the catch basin. Stormwater was discharged under a NPDES General Stormwater Discharge Permit No. 1200-Z, File No. 109938, ORR70-2234. The discharge point was not identified in the available files. The current stormwater system could not be verified in the files reviewed for this report.

10.3.2. General or Individual Stormwater Permit [Current or Past] ☒ Yes ☐ No

Permit Type	File Number	Start Date	Outfalls	Parameters/Frequency
NPDES	109938	Prior to 1999		Unknown
GEN 12Z		Prior to 1999		Standard[1]

[1] Standard GEN12Z permit requirements include pH, oil and grease, total suspended solids, copper, lead, and zinc. *E. coli* may also be required.

Do other non-stormwater wastes discharge to the system? ☐ Yes ☒ No

10.3.3. Stormwater Data ☐ Yes ☒ No

10.3.4. Catch Basin Solids Data ☐ Yes ☒ No

10.3.5. Wastewater Permit ☐ Yes ☒ No

No wastewater permit was identified in the documents reviewed.

10.3.6. Wastewater Data ☐ Yes ☒ No

10.3.7. Summary

Prior to 1999, any stormwater runoff was collected in the storm drain catch basin, which was fitted with a multi-media insert designed to control sediment, petroleum hydrocarbons, and debris and to keep the material from entering the Willamette River, which is the ultimate discharge point of the catch basin. No additional information is available on stormwater collection methods from this site since Time Oil's sale of the facility in 1999.

10.4. Sediment

10.4.1. River Sediment Data ☒ Yes ☐ No

Roy F. Weston, Inc. collected two shallow sediment samples (SD050 and SD052) adjacent to the ST Services facility during the 1997 Portland Harbor sediment investigation (Weston 1998). Four shallow sediment samples were also collected by Battelle in 2002 (Battelle 2002). Analyses included conventionals, grain size, metals, pesticides, phenols, phthalates, VOCs, and SVOCs.

Results from the Weston and Battelle investigations are summarized in Table 2.

10.4.2. Summary

See Final CSM Update.

11. CLEANUP HISTORY AND SOURCE CONTROL MEASURES

11.1. Soil Cleanup/Source Control

Soils impacted with petroleum hydrocarbons were excavated and aerated onsite following the 1988 (175 cubic yards) and 1992 (125 cubic yards) releases of gasoline to soil. In addition, a soil vapor extraction system was operated in 1993 and between March and May 1997 to address residual contamination in soil in the vicinity of the releases. Vapor samples collected from the vapor extraction system in 1997 did not contain detectable levels of petroleum hydrocarbons; system operation was discontinued after two months.

11.2. Groundwater Cleanup/Source Control

Petroleum hydrocarbon concentrations were not detected in groundwater or decreased to concentrations below detection during groundwater monitoring conducted from 1994 to 1997. No cleanup or source control of groundwater was executed because groundwater concentrations were not significantly impacted by the petroleum hydrocarbons in soil.

11.3. Other

11.4. Potential for Recontamination from Upland Sources

See Final CSM Update.

12. BIBLIOGRAPHY / INFORMATION SOURCES

References cited:

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DEQ. 2004. DEQ Site Summary Report – Details for Site ID 1989. DEQ Environmental Cleanup Site (ECSI) Database. Accessed March 24, 2005, http://www.deq.state.or.us/wmc/ecsi/ecsidetail.asp?seqnbr=1989.

DEQ. 1999. DEQ Strategy Recommendation – Time Oil Co. Linnton Terminal. November 18, 1999. Site Assessment Program, Oregon Department of Environmental Quality, Portland, OR.

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Integral and DEA. 2004. Lower Willamette River February 2004 Multibeam Bathymetric Survey Report. Draft. Prepared for Lower Willamette Group, Portland, OR. Prepared by Integral Consulting, Inc. (Olympia, WA) and David Evans and Associates, Inc. (Portland, OR).

Integral, Windward, Kennedy/Jenks, Anchor Environmental, and Groundwater Solutions. 2004. Portland Harbor RI/FS Programmatic Work Plan. Prepared for the Lower Willamette Group, Portland, OR. Integral Consulting, Inc., Mercer Island, WA.

Weston. 1998. Portland Harbor Sediment Investigation Report, Multnomah County, Oregon. No. 04000-019-036-AACE. Prepared for U.S. Environmental Protection Agency and Oregon Department of Environmental Quality. Roy F. Weston, Inc., Seattle, WA.

Other relevant references/information sources:

Figures:

Figure 1. Site Features

Tables:

Table 1. Potential Sources and Transport Pathways Assessment
Table 2. Queried Sediment Chemistry Data

Supplemental Figures:

Figure 3. Site Plan

FIGURES

Figure 1. Site Features

-35

LPSG-S-024-R-1

SD050

LPSG-S-023-R-1

LPSG-S-022-R-1

SD052

LPSG-S-021-R-1

WR-209

WR-152

WR-212

WR-210

WR-371

WR-372

3PL

3AB

ST Services/Shore Terminal 1989

Foss Maritime / Brix Maritir

ST HELENS RD

Legend

ST Services Sediment Samples

Samples Queried from Historical Database for Inclusion in Table 2
site_code, reference

- WLCASF97, 1997 PAH Sed. Inv. (Battelle 2002)
- WR-WSI98, Portland Harbor SI (Weston 1998)

Round 1 and Historical Samples Not Queried for Inclusion in Table 2

- Round 1 Sediment Samples
- Historical Sediment Samples

Integral consulting inc.

LWG Lower Willamette Group

Map Document: (C:\GIS\Projects\Portland_Harbor\LWG-Map-Projects\Conseptual_Site_Model\Sample_Locations_3rd_Group.mxd)
Plot Date: 08/30/2005

Areal Photo Date: October 2001.
Base Map features from Portland Metro's RLIS.

Outfall information contained on this map is accurate according to available records; however, the City of Portland makes no warranty, expressed or implied, as to the completeness or accuracy of the information published (updated June 2005).

Legend

- Outfalls
- Seep Photo Location (Not location of actual Seep)
- Selected ECSI Site Property Boundary
- Navigation Channel
- Docks & In-water Structures
- River Miles
- -35ft. Contour (NAVD 88)

Human Use Areas

- Dockside Worker
- Recreational Beach Use
- Transient

LWG Round 2 Proposed Sediment Samples

- Surface Sample Only
- Core & Surface Sample

0 50 100 200 Feet

DRAFT

DO NOT QUOTE OR CITE. This document is currently under review by US EPA and its federal, state, and tribal partners, and is subject to change in whole or in part.

Figure 1-Site Features
Portland Harbor RI/FS
Conceptual Site Model
ST Services
ECSI 1989

TABLES

ST Services/Shore Terminals

Table 1. Potential Sources and Transport Pathways Assessment

	Media Impacted					COIs																Potential Complete Pathway				
						TPH			VOCs																		
Description of Potential Source	**Surface Soil**	**Subsurface Soil**	**Groundwater**	**Catch Basin Solids**	**River Sediment**	**Gasoline-Range**	**Diesel - Range**	**Heavier - Range**	**Petroleum-Related (e.g. BTEX)**	**VOCs**	**Chlorinated VOCs**	**SVOCs**	**PAHs**	**Phthalates**	**Phenolics**	**Metals**	**PCBs**	**Herbicides and Pesticides**	**Dioxins/Furans**	**Butyltins**	**Overland Transport**	**Groundwater**	**Direct Discharge - Overwater**	**Direct Discharge - Storm/Wastewater**	**Riverbank Erosion**
Upland Areas																										
Terminal tank farm	✓	✓	✓			✓	✓		✓																	
Overwater Areas																										
Dock Operations					✓	✓	✓		✓																	
Other Areas/Other Issues																										

Notes:

All information provided in this table is referenced in the site summaries. If information is not available or inconclusive, a ? may be used, as appropriate. No new information is provided in this table.

✓ = Source, COI are present or current or historic pathway is determined to be complete or potentially complete.

? = There is not enough information to determine if source or COI is present or if pathway is complete.

Blank = Source, COI and historic and current pathways have been investigated and shown to be not present or incomplete.

UST	Underground storage tank
AST	Above-ground storage tank
TPH	Total petroleum hydrocarbons
VOCs	Volatile organic compounds
SVOCs	Semivolatile organic compounds
PAHs	Polycyclic aromatic hydrocarbons
BTEX	Benzene, toluene, ethylbenzene, and xylenes
PCBs	Polychorinated biphenols

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	Total organic carbon (percent)	6	6	100	1.1	2.8	1.82	1.8	2	1.1	2.8	1.82	1.8	2
surface	Gravel (percent)	6	6	100	0.03	0.33	0.177	0.1	0.3	0.03	0.33	0.177	0.1	0.3
surface	Sand (percent)	2	2	100	40.99	52.23	46.6	40.99	40.99	40.99	52.23	46.6	40.99	40.99
surface	Very coarse sand (percent)	4	4	100	0.1	0.4	0.275	0.3	0.3	0.1	0.4	0.275	0.3	0.3
surface	Coarse sand (percent)	4	4	100	0.7	3.6	2.15	1.8	2.5	0.7	3.6	2.15	1.8	2.5
surface	Medium sand (percent)	4	4	100	1.6	14.3	7.25	5.9	7.2	1.6	14.3	7.25	5.9	7.2
surface	Fine sand (percent)	4	4	100	5.7	19.7	11.4	8.9	11.2	5.7	19.7	11.4	8.9	11.2
surface	Very fine sand (percent)	4	4	100	13.7	19.5	16.1	15	16.2	13.7	19.5	16.1	15	16.2
surface	Fines (percent)	2	2	100	47.73	58.68	53.2	47.73	47.73	47.73	58.68	53.2	47.73	47.73
surface	Silt (percent)	2	2	100	39.61	47.45	43.5	39.61	39.61	39.61	47.45	43.5	39.61	39.61
surface	Coarse silt (percent)	4	4	100	17	26	20.9	18.6	21.9	17	26	20.9	18.6	21.9
surface	Medium silt (percent)	4	4	100	12.2	14.1	13.2	12.8	13.8	12.2	14.1	13.2	12.8	13.8
surface	Fine silt (percent)	4	4	100	9	11.4	9.8	9.1	9.7	9	11.4	9.8	9.1	9.7
surface	Very fine silt (percent)	4	4	100	5.9	7.9	6.78	6.5	6.8	5.9	7.9	6.78	6.5	6.8
surface	Clay (percent)	2	2	100	8.13	11.23	9.68	8.13	8.13	8.13	11.23	9.68	8.13	8.13
surface	8-9 Phi clay (percent)	4	4	100	3.6	4.2	3.78	3.6	3.7	3.6	4.2	3.78	3.6	3.7
surface	9-10 Phi clay (percent)	4	4	100	2.6	3	2.83	2.8	2.9	2.6	3	2.83	2.8	2.9
surface	>10 Phi clay (percent)	4	4	100	5	5.6	5.4	5.5	5.5	5	5.6	5.4	5.5	5.5
surface	Aluminum (mg/kg)	2	2	100	33200	37600	35400	33200	33200	33200	37600	35400	33200	33200
surface	Antimony (mg/kg)	2	0	0						5 UJ	5 UJ	5	5 UJ	5 UJ
surface	Arsenic (mg/kg)	2	0	0						5 U	5 U	5	5 U	5 U
surface	Cadmium (mg/kg)	2	2	100	0.3	0.4	0.35	0.3	0.3	0.3	0.4	0.35	0.3	0.3
surface	Chromium (mg/kg)	2	2	100	31.9	36.1	34	31.9	31.9	31.9	36.1	34	31.9	31.9
surface	Copper (mg/kg)	2	2	100	35.5	37.9	36.7	35.5	35.5	35.5	37.9	36.7	35.5	35.5
surface	Lead (mg/kg)	2	2	100	13	16	14.5	13	13	13	16	14.5	13	13
surface	Manganese (mg/kg)	2	2	100	595	716	656	595	595	595	716	656	595	595
surface	Mercury (mg/kg)	2	2	100	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
surface	Nickel (mg/kg)	2	2	100	26.4	27.6	27	26.4	26.4	26.4	27.6	27	26.4	26.4
surface	Selenium (mg/kg)	2	2	100	9	10	9.5	9	9	9	10	9.5	9	9
surface	Silver (mg/kg)	2	2	100	0.7	1	0.85	0.7	0.7	0.7	1	0.85	0.7	0.7
surface	Thallium (mg/kg)	2	1	50	20	20	20	20	20	5 U	20	12.5	5 U	5 U
surface	Zinc (mg/kg)	2	2	100	85.4 J	98.6	92	85.4 J	85.4 J	85.4 J	98.6	92	85.4 J	85.4 J
surface	Barium (mg/kg)	2	2	100	162	179	171	162	162	162	179	171	162	162
surface	Beryllium (mg/kg)	2	2	100	0.55	0.66	0.605	0.55	0.55	0.55	0.66	0.605	0.55	0.55
surface	Calcium (mg/kg)	2	2	100	7920	8340 J	8130	7920	7920	7920	8340 J	8130	7920	7920
surface	Cobalt (mg/kg)	2	2	100	16.8 J	18.3	17.6	16.8 J	16.8 J	16.8 J	18.3	17.6	16.8 J	16.8 J
surface	Iron (mg/kg)	2	2	100	37400	41500	39500	37400	37400	37400	41500	39500	37400	37400
surface	Magnesium (mg/kg)	2	2	100	6120	6460	6290	6120	6120	6120	6460	6290	6120	6120
surface	Potassium (mg/kg)	2	2	100	1110	1270	1190	1110	1110	1110	1270	1190	1110	1110
surface	Sodium (mg/kg)	2	2	100	1120	1130	1130	1120	1120	1120	1130	1130	1120	1120
surface	Vanadium (mg/kg)	2	2	100	92.5	101	96.8	92.5	92.5	92.5	101	96.8	92.5	92.5
surface	2-Methylnaphthalene (ug/kg)	2	2	100	32	50	41	32	32	32	50	41	32	32
surface	Acenaphthene (ug/kg)	6	6	100	53	12173	2080	61	70	53	12173	2080	61	70
surface	Acenaphthylene (ug/kg)	6	6	100	20	730	150	35	47	20	730	150	35	47
surface	Anthracene (ug/kg)	6	6	100	75	9904	1730	96	132	75	9904	1730	96	132
surface	Fluorene (ug/kg)	6	6	100	44	7697	1330	56	69	44	7697	1330	56	69
surface	Naphthalene (ug/kg)	6	6	100	37	2500	481	86	108	37	2500	481	86	108
surface	Phenanthrene (ug/kg)	6	6	100	279	48731	8430	343	499	279	48731	8430	343	499

Table 2. Queried Sediment Chemistry Data

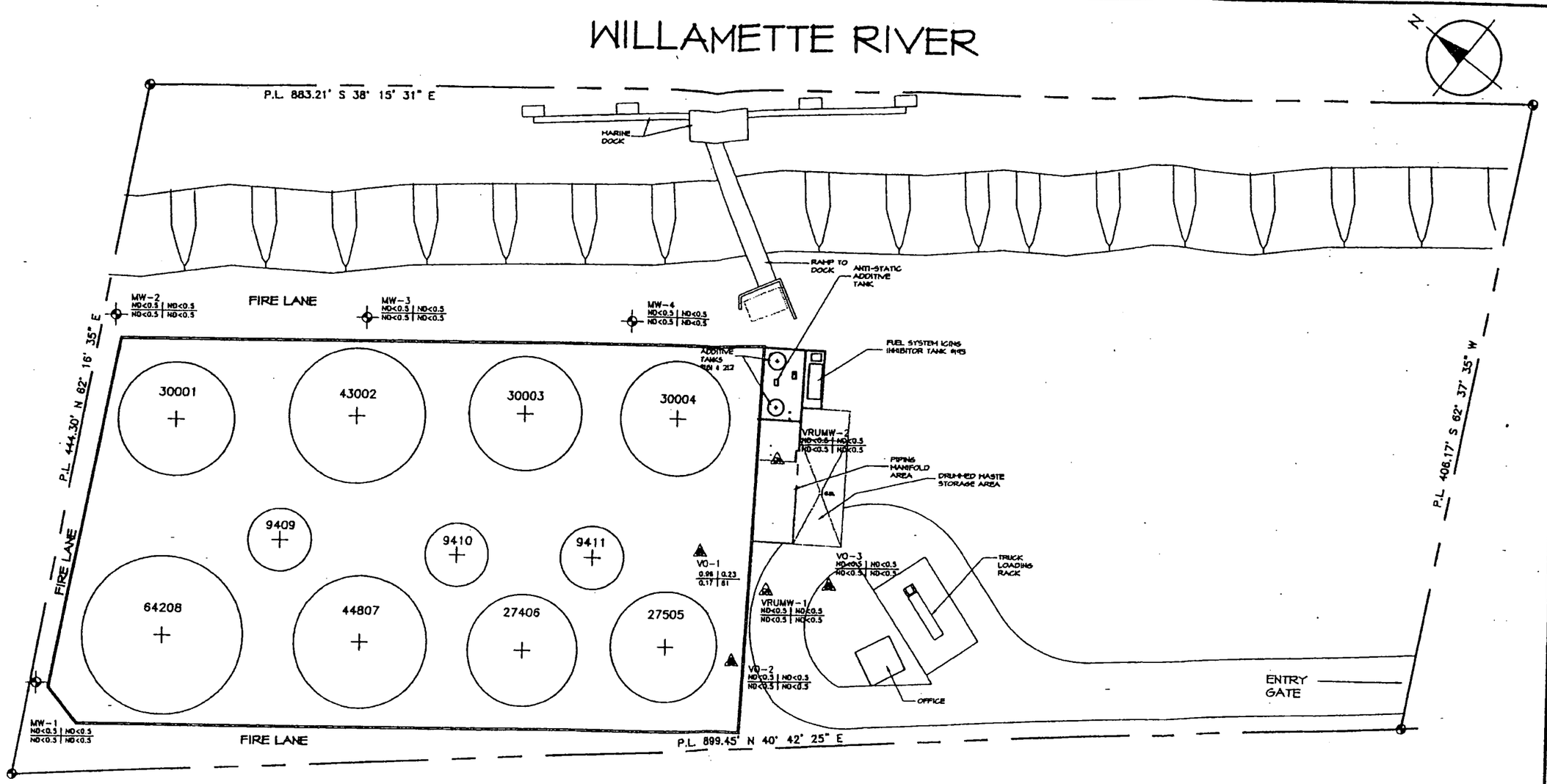
Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Detected Concentrations Maximum	Detected Concentrations Mean	Detected Concentrations Median	Detected Concentrations 95th	Detected and Nondetected Concentrations Minimum	Detected and Nondetected Concentrations Maximum	Detected and Nondetected Concentrations Mean	Detected and Nondetected Concentrations Median	Detected and Nondetected Concentrations 95th
surface	Low Molecular Weight PAH (ug/kg)	6	6	100	523 A	81735 A	14200	657 A	912 A	523 A	81735 A	14200	657 A	912 A
surface	Dibenz(a,h)anthracene (ug/kg)	6	6	100	42	1242	253	56	67	42	1242	253	56	67
surface	Benz(a)anthracene (ug/kg)	6	6	100	190	10201	1920	261	371	190	10201	1920	261	371
surface	Benzo(a)pyrene (ug/kg)	6	6	100	140	13041	2480	389	472	140	13041	2480	389	472
surface	Benzo(b)fluoranthene (ug/kg)	6	6	100	190	7457	1480	283	380	190	7457	1480	283	380
surface	Benzo(g,h,i)perylene (ug/kg)	6	5	83.3	319	10452	2360	332	394	20 U	10452	1970	320	394
surface	Benzo(k)fluoranthene (ug/kg)	2	2	100	220	320	270	220	220	220	320	270	220	220
surface	Chrysene (ug/kg)	6	6	100	260	12631	2390	310	442	260	12631	2390	310	442
surface	Fluoranthene (ug/kg)	6	6	100	415	33363	6040	478	785	415	33363	6040	478	785
surface	Indeno(1,2,3-cd)pyrene (ug/kg)	6	6	100	89	9291	1770	308	363	89	9291	1770	308	363
surface	Pyrene (ug/kg)	6	6	100	380	41387	7400	539	823	380	41387	7400	539	823
surface	Benzo(b+k)fluoranthene (ug/kg)	2	2	100	410 A	610 A	510	410 A	410 A	410 A	610 A	510	410 A	410 A
surface	Benzo(j+k)fluoranthene (ug/kg)	4	4	100	261	8273	2280	264	340	261	8273	2280	264	340
surface	High Molecular Weight PAH (ug/kg)	6	6	100	1941 A	147338 A	27300	3198 A	4431 A	1941 A	147338 A	27300	3198 A	4431 A
surface	Polycyclic Aromatic Hydrocarbons (ug/kg)	6	6	100	2536 A	229073 A	41500	3855 A	5343 A	2536 A	229073 A	41500	3855 A	5343 A
surface	Benzo(e)pyrene (ug/kg)	4	4	100	254	7792	2160	257	333	254	7792	2160	257	333
surface	C1-Dibenzothiophene (ug/kg)	4	4	100	26	2847	736	32	38	26	2847	736	32	38
surface	C1-Chrysene (ug/kg)	4	4	100	191	3718	1090	217	238	191	3718	1090	217	238
surface	C1-Fluorene (ug/kg)	4	4	100	24	2624	677	24	35	24	2624	677	24	35
surface	C1-Naphthalene (ug/kg)	4	4	100	21	3478	891	27	38	21	3478	891	27	38
surface	C1-Fluoranthene/pyrene (ug/kg)	4	4	100	267	10205	2800	330	398	267	10205	2800	330	398
surface	C1-Phenanthrene/anthracene (ug/kg)	4	4	100	146	12246	3200	163	232	146	12246	3200	163	232
surface	C2-Dibenzothiophene (ug/kg)	4	4	100	43	2508	669	55	71	43	2508	669	55	71
surface	C2-Chrysene (ug/kg)	4	4	100	92	1269	395	97	123	92	1269	395	97	123
surface	C2-Fluorene (ug/kg)	4	4	100	30	2282	598	39	42	30	2282	598	39	42
surface	C2-Naphthalene (ug/kg)	4	4	100	38	9421	2390	45	49	38	9421	2390	45	49
surface	C2-Fluoranthene/pyrene (ug/kg)	4	4	100	127	2618	769	157	173	127	2618	769	157	173
surface	C2-Phenanthrene/anthracene (ug/kg)	4	4	100	155	7289	1970	207	213	155	7289	1970	207	213
surface	C3-Dibenzothiophene (ug/kg)	4	4	100	44	1468	407	55	60	44	1468	407	55	60
surface	C3-Chrysene (ug/kg)	4	4	100	53	537	178	57	65	53	537	178	57	65
surface	C3-Fluorene (ug/kg)	4	4	100	47	1815	498	64	65	47	1815	498	64	65
surface	C3-Naphthalene (ug/kg)	4	4	100	44	8314	2110	45	50	44	8314	2110	45	50
surface	C3-Fluoranthene/pyrene (ug/kg)	4	4	100	76	1102	338	84	90	76	1102	338	84	90
surface	C3-Phenanthrene/anthracene (ug/kg)	4	4	100	129	3614	1020	162	181	129	3614	1020	162	181
surface	C4-Dibenzothiophene (ug/kg)	4	4	100	34	604	178	35	38	34	604	178	35	38
surface	C4-Chrysene (ug/kg)	4	4	100	13	219	66.5	16	18	13	219	66.5	16	18
surface	C4-Naphthalene (ug/kg)	4	4	100	35	3986	1030	40	40	35	3986	1030	40	40
surface	C4-Phenanthrene/anthracene (ug/kg)	4	4	100	55	989	293	61	66	55	989	293	61	66
surface	Total benzofluoranthenes (b+k (+j)) (ug/kg)	4	4	100	541	15730	4380	547	720	541	15730	4380	547	720
surface	Diphenyl (ug/kg)	4	4	100	8	446	121	12	18	8	446	121	12	18
surface	2,4,5-Trichlorophenol (ug/kg)	2	0	0						99 U	100 U	99.5	99 U	99 U
surface	2,4,6-Trichlorophenol (ug/kg)	2	0	0						99 U	100 U	99.5	99 U	99 U
surface	2,4-Dichlorophenol (ug/kg)	2	0	0						60 U	60 U	60	60 U	60 U
surface	2,4-Dimethylphenol (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	2,4-Dinitrophenol (ug/kg)	1	0	0						200 UJ	200 UJ	200	200 UJ	200 UJ
surface	2-Chlorophenol (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	2-Methylphenol (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U

Table 2. Queried Sediment Chemistry Data

Surface or Subsurface	Analyte	Number of Samples	Number Detected	% Detected	Detected Concentrations Minimum	Maximum	Mean	Median	95th	Detected and Nondetected Concentrations Minimum	Maximum	Mean	Median	95th
surface	2-Nitrophenol (ug/kg)	2	0	0						99 U	100 U	99.5	99 U	99 U
surface	4,6-Dinitro-2-methylphenol (ug/kg)	2	0	0						200 U	200 UJ	200	200 U	200 U
surface	4-Chloro-3-methylphenol (ug/kg)	2	0	0						40 U	40 U	40	40 U	40 U
surface	4-Methylphenol (ug/kg)	2	2	100	21	600	311	21	21	21	600	311	21	21
surface	4-Nitrophenol (ug/kg)	2	0	0						99 U	100 U	99.5	99 U	99 U
surface	Pentachlorophenol (ug/kg)	2	0	0						99 UJ	100 UJ	99.5	99 UJ	99 UJ
surface	Phenol (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	Dimethyl phthalate (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	Diethyl phthalate (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	Dibutyl phthalate (ug/kg)	2	0	0						20 UJ	20 U	20	20 UJ	20 UJ
surface	Butylbenzyl phthalate (ug/kg)	2	1	50	29	29	29	29	29	20 U	29	24.5	20 U	20 U
surface	Di-n-octyl phthalate (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	Bis(2-ethylhexyl) phthalate (ug/kg)	2	1	50	150	150	150	150	150	150	190 U	170	150	150
surface	Bis(2-chloro-1-methylethyl) ether (ug/kg)	2	0	0						20 U	20 UJ	20	20 U	20 U
surface	2,4-Dinitrotoluene (ug/kg)	2	0	0						99 U	100 U	99.5	99 U	99 U
surface	2,6-Dinitrotoluene (ug/kg)	2	0	0						99 U	100 U	99.5	99 U	99 U
surface	2-Chloronaphthalene (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	2-Nitroaniline (ug/kg)	2	0	0						99 U	100 U	99.5	99 U	99 U
surface	3,3'-Dichlorobenzidine (ug/kg)	2	0	0						99 U	100 U	99.5	99 U	99 U
surface	3-Nitroaniline (ug/kg)	2	0	0						120 U	120 UJ	120	120 U	120 U
surface	4-Bromophenyl phenyl ether (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	4-Chloroaniline (ug/kg)	2	0	0						60 U	60 UJ	60	60 U	60 U
surface	4-Chlorophenyl phenyl ether (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	4-Nitroaniline (ug/kg)	2	0	0						99 UJ	100 UJ	99.5	99 UJ	99 UJ
surface	Benzoic acid (ug/kg)	2	0	0						200 U	200 U	200	200 U	200 U
surface	Benzyl alcohol (ug/kg)	2	0	0						20 UJ	20 UJ	20	20 UJ	20 UJ
surface	Bis(2-chloroethoxy) methane (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	Bis(2-chloroethyl) ether (ug/kg)	2	0	0						40 U	40 UJ	40	40 U	40 U
surface	Carbazole (ug/kg)	2	2	100	30	100 J	65	30	30	30	100 J	65	30	30
surface	Dibenzofuran (ug/kg)	6	6	100	16	826	159	26	31	16	826	159	26	31
surface	Hexachlorobenzene (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	Hexachlorobutadiene (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	Hexachlorocyclopentadiene (ug/kg)	2	0	0						99 UJ	100 UJ	99.5	99 UJ	99 UJ
surface	Hexachloroethane (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	Isophorone (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	Nitrobenzene (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	N-Nitrosodipropylamine (ug/kg)	2	0	0						40 U	40 U	40	40 U	40 U
surface	N-Nitrosodiphenylamine (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	Dibenzothiophene (ug/kg)	4	4	100	35	7549	1920	38	54	35	7549	1920	38	54
surface	Perylene (ug/kg)	4	4	100	154	3322	959	171	188	154	3322	959	171	188
surface	1,2-Dichlorobenzene (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	1,3-Dichlorobenzene (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	1,4-Dichlorobenzene (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U
surface	1,2,4-Trichlorobenzene (ug/kg)	2	0	0						20 U	20 U	20	20 U	20 U

SUPPLEMENTAL FIGURES

Figure 3. Site Plan



LEGEND

- GROUNDWATER MONITORING WELL
- VAPOR EXTRACTION/OBSERVATION WELL
- COMBINED GROUNDWATER RECOVERY/VAPOR EXTRACTION WELL
- B | T / E | X — CONCENTRATION OF CONSTITUENTS IN MICROGRAMS PER LITER
- B BENZENE
- T TOLUENE
- E ETHYLBENZENE
- X TOTAL XYLENES
- ND NOT DETECTED ABOVE REPORTED DETECTION LIMIT
- 0.005 — CALCULATED GROUNDWATER GRADIENT DIRECTION AND MAGNITUDE IN FOOT PER FOOT

Figure 3

TIME OIL CO.	
2737 WEST COMMODORE WAY SEATTLE, WA. 98199	
SCALE: 1"=80'	TITLE: SITE PLAN
DATE: 8/26/99	PROJECT #: 98-042
DRAWN BY: SANDHOP	SHEET: 1 OF 1
CHECKED:	LOCATION: 9100 ST. HELENS ROAD LINNTON, OR
	DRAWING NO.: 3292